

# The suggested system for health insurance Application based on Smart Cards

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## Abstract

This paper concentrates on designing a system for Health insurance using smart card technology .The system is called HISS (Health insurance system using smart card).As we will see the system is web based application based on central database ,uses smart card for two reasons first, as a data carrier for patient and professionals. Second reason is for authentication purposes. There are some figures that describe system architecture and processes then each component will be explained.

## 1. Healthcare & Medical Service in Egypt <sup>[URL 1]</sup>

The Egyptian Government, through the Ministry of Health and Population, gives high priority to the provision of public health services. It has made substantive progress in improving the health status of its constantly increasing population (more than 70 million & is estimated to reach 100 million by year 2020). In 2001/2 the government expenditure on healthcare was LE 3.64 billion & investment was LE 2.12 billion.

Past and ongoing Public Health sector improvement projects either financed locally or by donors, have generally focused either on specific narrow sector issues and/or on targeted population groups. These have not

been sufficient to face increased financial pressures resulting from the growing disease burden, population growth, and new and costly medical technologies. They also failed to sustain initial improvement in health conditions and needed to be complemented by fundamental changes in policies. It is generally considered that centralized and fragmented management and combined financing and provision have also led to inefficient use of resources. Consequently, the need for reform existed to increase accountability, transparency and efficiency by clarifying roles, separating finance from provision, and developing needed technical capacities. Public Health Sector being restructured to improve the health service and to provide all Egyptians with effective 'health security'. A pilot reform programmed has been launched.

### 1.1. Problems in HIO (Health insurance Organization):

HIO (Health insurance Organization) is the biggest organization that provide healthcare in Egypt .HIO serves about 25 million insured persons, it has many branches all over Egypt. Although HIO has a hierarchal structure and considered organized more than any healthcare authority, it has some problems affects service quality to insured persons and wastes lot resources, problems such as:

- Poor IT infrastructure

- Wasted time and money for professionals and patients
  - Bad inventory management
  - Limited primary health care services .
  - Absence of real recognition of ‘infection control’ procedures and protocols .
  - Most of the equipment in Public hospitals is obsolete or under-maintained .
  - Centralized management of the Public healthcare sector .
  - Public healthcare sector management is fragmented as public hospitals belong to the Ministry of Health, Ministry of Higher Education or military, as well as by some public companies to serve their employees.
- State-employed doctors and nurses suffer from difficult working conditions, low pay and lack of oversight to enforce performance standards.

The private sector has developed during the last two decades & achieved some regional recognition. It continues to grow, and is targeting high worth Egyptians and attracting international visitors.

## 2. Proposed System architecture

Figure 1 illustrates an overview of a typical integrated information system to manage health insurance over multiple hospitals and medical centers.

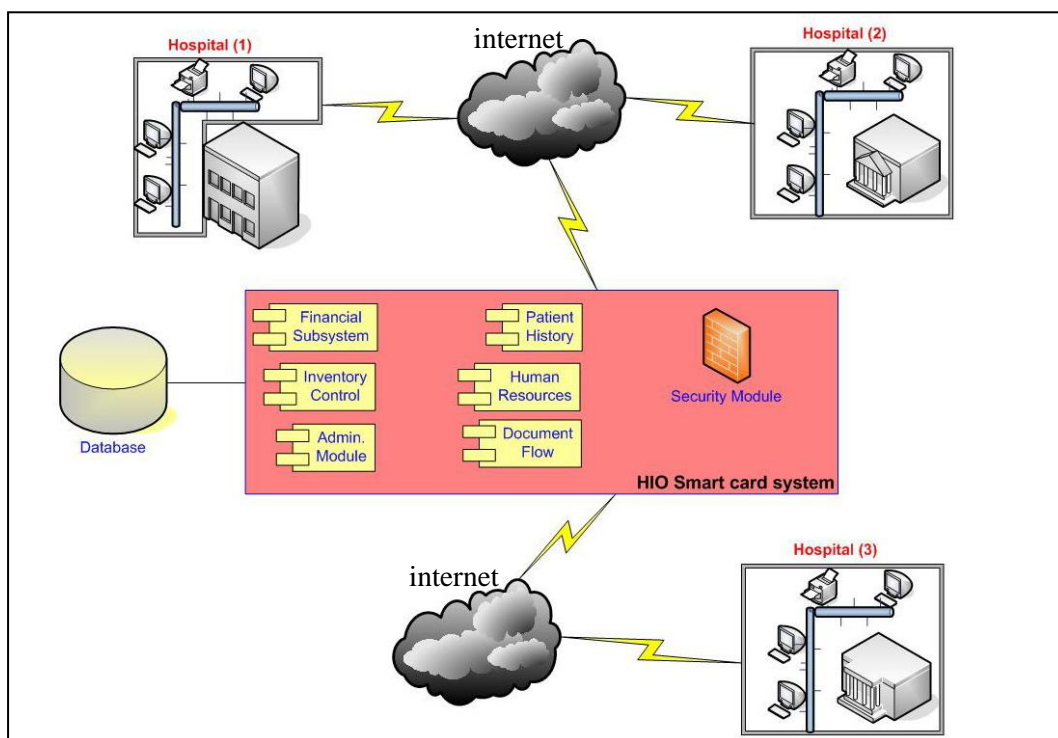


Figure 1: A common model of interoperable architecture of a web-smart-card-based information system

The proposed system is typically a web-based system as it connects all HIO locations with internet connection .The proposed system enable users to access the system from internet browsers. Each Location has a local database which replicates to the central database. At this

point we have to notice that all subsystems work on the same central database located on the server farm. Also, all subsystems are integrated with each other to perform the functionality of the whole system. It is important to point that using smartcard , web

based connection which considered a client server architecture and database replication increase the proposed system reliability and availability. The system consists of the following subsystems:

- Patient Information and Case History Subsystem.
- Human Resources Subsystem.
- Document Flow Subsystem.
- Inventory Control Subsystem.
- Administration subsystem.
- Security subsystem.

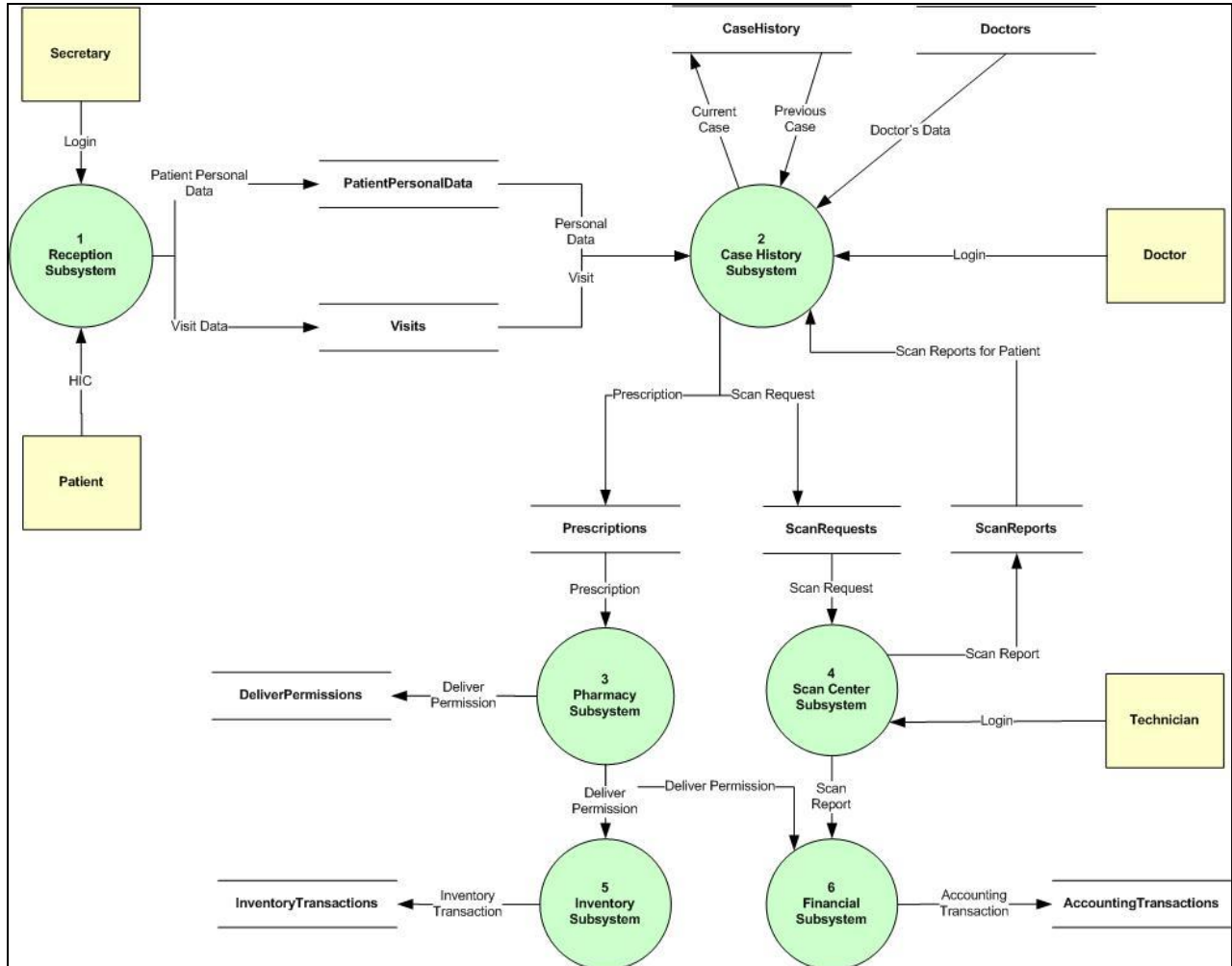
### **2.1. Proposed System Objectives**

The proposed System has several objectives such as:

- Increase the quality of medical services to the insured and simplify the procedures involved.
- Improve communication between the HIO, healthcare users and healthcare providers.
- Improve data security and confidentiality.
- Reduce administrative tasks for the insured, healthcare providers, health insurance companies, employers, and the HIO.
- Increase operating efficiency within the HIO and the healthcare providers.
- Make the investment at a national level as cost-beneficial as possible.

## 2.2. Level zero data flow diagram

Figure 2 shows the major subsystems that are considered the components of the system. The figure demonstrates the main data flows between subsystems. Each subsystem details will be explained in the following subsections:



### A. Patient Information and Case History Subsystem.

The responsibility of this subsystem is to manage and handle all information related to patient either personal or medical data. It creates a whole isolated profile for each patient includes all related data. As proposed; patient profile consists of patient personal data and the history of all visits and medical reports of the patient occurred in all hospitals of health insurance system. This subsystem uses HIC (*health insured person card*) and using some features they can increase service quality, independence and autonomy in confirming administrative data. Patient can register electronically at any HIO health care facility in a manner that is fast, user friendly and reliable. Detailed features are:

- 1- Reading and writing personal data can be done based on HIC see example for HIC figure (3).
- 2- Adding, browsing and search personal data of patient.
- 3- Adding new patient personal data creates and initiating a new patient profile.
- 4- Entering basic medical information of patient like weight, height, allergies any previous surgeries.
- 5- Adding new page for each visit includes symptoms, diagnosis, treatment and any required investigations or scans.
- 6- All fields in the case history module are auto-complete fields which assists doctor for fast data entry.
- 7- Every recorded visit for patient preserves the user name of its doctor and can't be edited by anyone rather than the doctor who created it and system admin according to security rules.
- 8- Attaching files (Electronic files or scanned reports) to patient's medical profile so HIC can save only URL to these attached files to save storage area on HIC smart card.  
*The card will store pointers (URL addresses) linking the card to the storage of x-rays, lab results and health records located in the databases of organizations where the services were performed.*
- 9- Fast print of prescription details including medicines, dosage, times, required investigations or scans and also logo of the center and doctor name which all are configurable to print or not.
- 10- Ability to print a report of the whole visit.
- 11- Ability to print a report of the whole case history of the patient which may include also the case history of his/her couple.
- 12- View Case History of couples into coupled view, which make it very easier to review progress over both at once.
- 13- Getting over the problems of managing same case between many doctors as the system gives abilities to all doctors to see notes of other doctors on the case.
- 14- This subsystem can Decrease the amount of time taken to perform patient registration and Decrease the number of recording errors in medical records.

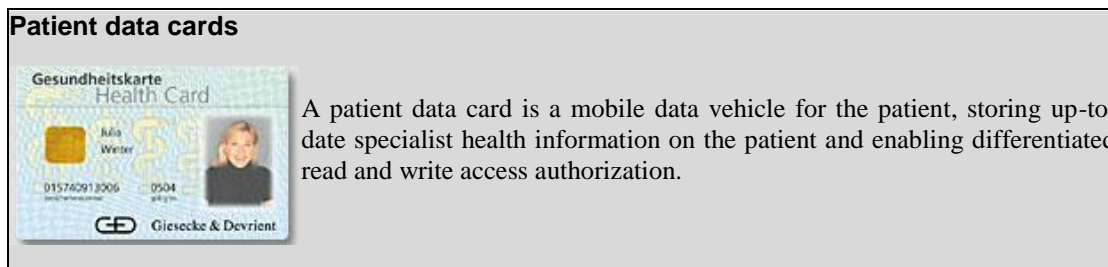


Figure 3: Example for Patient card

### B. Human Resource subsystem

HR subsystem is responsible for managing employees' data, attendance and payrolls integrating with Financials subsystem to generate financial transactions of payrolls. It perform the following tasks:

- 1- Managing HPC (Health Professional Card) or (Health Physicians Card) allows to Enter, browse, read and write employee personal and work data. See example for HPC figure (4).
- 2- Supporting entering attendance times of employees using HPC smart cards.

- 3- Supporting loans and scheduling loans payments back.
- 4- Supporting insurance and other salary items.
- 5- Handling different weekend days for each employee and different work shifts.
- 6- Generating monthly salary report according to gathered data.
- 7- Reporting wizard for employee attendance.
- 8- Integration with Financial module to generate financial transactions.

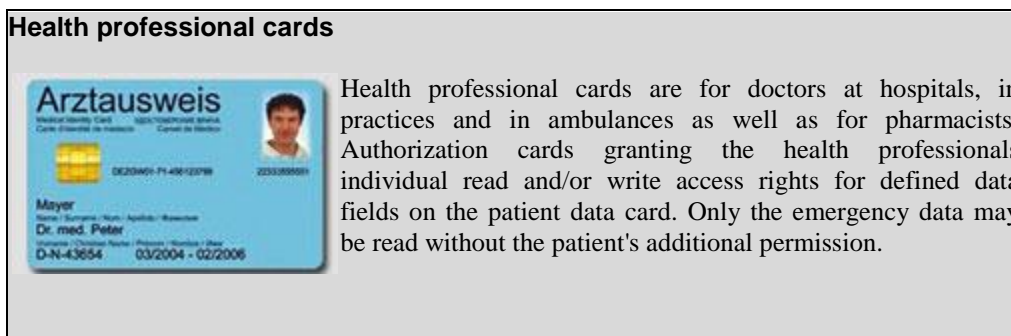


Figure.4: Example for professional card

### C. Document Flow Subsystem

This module is responsible for storing management documents and managing moving it forward and backward through the system. It keeps a history for each document about creation date, all processes applied to it and user who applied each process. This module work as EDI technique (Electronic Data Interchange) it helps in the following processes:

- 1- Adding and browsing documents.
- 2- Attaching document either in an electronic format (Word document, excel file ...) or by scanning paper document.
- 3- Applying customized security levels by the creator of the document.
- 4- Attaching notes and related data (ex. Document type, Department, Source, Distinction ...) to document.

- 5- Sending single document or group of related documents to another user on the system.
- 6- Simple and advanced search for reports and documents.

This subsystem increase in productivity among staff due to less time dealing with paperwork.

### **E-prescription offers high savings potential**

To keep patient documents two alternatives for transfer of the electronic prescription data to pharmacies and insurers are currently under discussion. Both are equally feasible from the technical point of view. In the card-based solution, the electronic prescription is saved directly to the patient's card after the doctor has used his health professional card to authenticate himself and has signed the prescription with his digital signature. At the pharmacy, the electronic prescription is read with the aid of a card reader and the pharmacist's HPC. When the medicine has been dispensed, the prescription is deleted from the health card and stored on the pharmacist's computer. In the server-based data transfer system, the signed and encrypted electronic prescription is transferred to a server via a protected connection. Using his HPC, the doctor writes a "ticket", generated by the server, to the patient's health card. This ticket and the pharmacist's HPC allow the prescription to be retrieved from the server, after which the drug can be dispensed. The e-prescription is then deleted from the server and stored locally at the pharmacy.

At regular intervals, all e-prescriptions stored at the pharmacy are sent to the central clearing points serving the pharmacy sector. As under the present system, these clearing centers settle

accounts with the health insurance organizations. According to a study carried out by Debold&Lux, introduction of the e-prescription alone will allow the German health service to save up to EUR 250 million a year .

Besides the cost savings achievable through fast data transfer, the e-prescription also offers a range of benefits for patients. The medication record stored optionally – and only with the patient's consent - on the card will let the pharmacist check for possible interaction between the prescribed drugs and any nonprescription medicines the customer may also be taking, or wish to take. The quality of the advice given in the pharmacy thus improves – especially for older people, who are not always able to remember what drugs they may be taking. Also, the registration of co-payment exemptions on the card will optimize the dispensing process. And the e-prescription, not being hand-written, is always legible – no more need to refer back to the doctor.

### **D. Financial Subsystem**

Financial subsystem integrates with other modules in the system in order to manage all financial transactions. That's beside managing purchases and journals.

- 1- Enter, edit and search purchasing bills which automatically generates its financial transactions.
- 2- Handling suppliers' accounts and payments out operations to suppliers.
- 3- Generating supplier's balance reports.
- 4- Integrates with Appointments Module to generate financial transactions of patient payments.



- 5- Integrates with Scan Center Module to generate financial transactions of patient payments.
- 6- Ability to enter petty expenses and generating its financial transactions automatically.
- 7- Ability to enter manual journals.
- 8- Report wizard of purchases in which purchases can be reported by period, supplier, item or category of items and also grouped by date, supplier or item category.
- 9- Generating final financial reports such as Income Statement report and balance sheet anytime of the year.

#### **E. Inventory Subsystem**

Inventory subsystem is responsible of all inventory transactions and reporting inventory amounts and transactions.

- 1- Enter, browse and search items of inventory.
- 2- Supporting multi-inventory system.
- 3- Ability to enter items into hierarchical tree of categories with unlimited levels.
- 4- Entering documents of importing items automatically generates its related inventory transactions.
- 5- Entering documents of exporting items to use automatically generates its related inventory transactions.

- 6- Alerting user when critical items amounts get to reorder level.
- 7- Reporting wizard of inventory transactions and inventory amounts within period of time grouped by item, date or category of items.
- 8- Report of items which reached reorder level.

#### **F. Administration & Security subsystem**

This subsystem gives the main tool of system administrator to manage the system and central database. It also gives him the ability to create different security levels and assign them to system users. This subsystem can do the following:

- 1- Creating main schedule of database backup creation.
- 2- Restoring database backups on any problem.
- 3- Creating defined security levels of the system.
- 4- Create, suspend system users and assign them security levels.

This subsystem also is responsible for insuring that data transfer is secure .It supports system in interacting with SSL protocol that make proposed system save.



### 2.3. Inside one Location

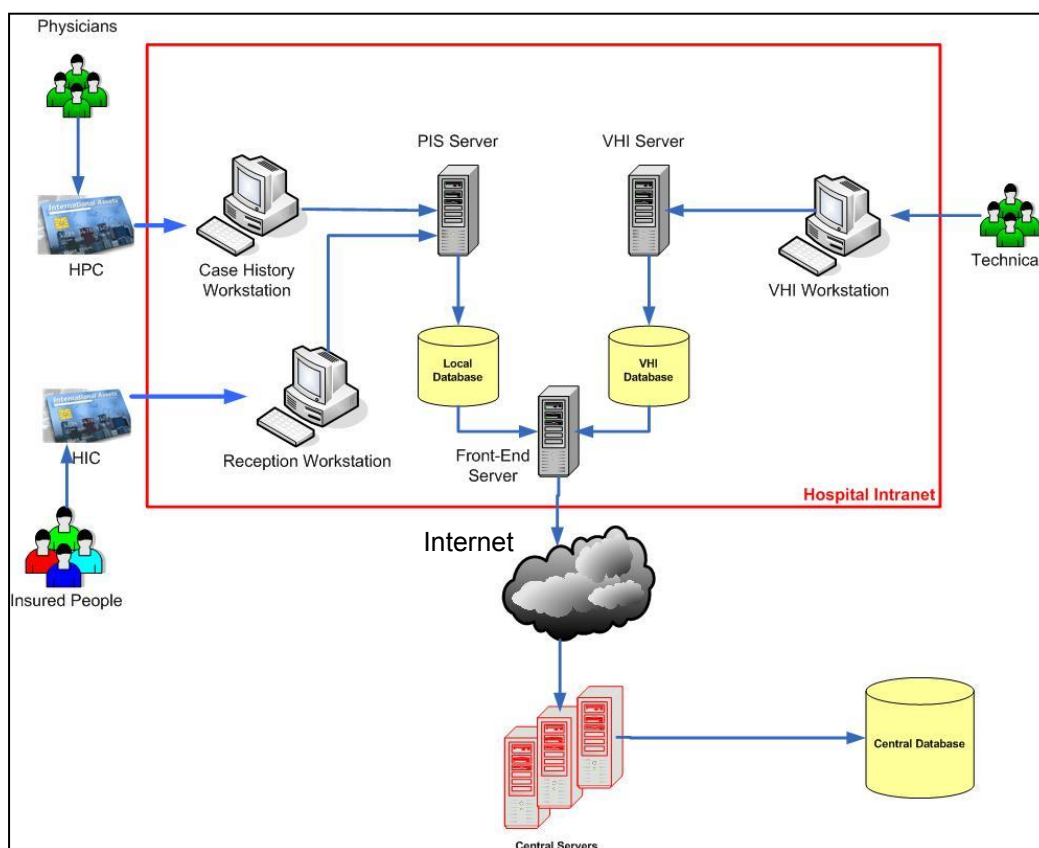


Figure 5: Subsystem in one location (single site)

Having a deeper look inside one location (hospital) to illustrate system deployment and business work flow, each location has three servers

#### A. PIS Server

The Patient information server (PIS) is where a local database is located. It is a database dedicated to store patient profiles locally before batching them to the main server.

#### B. VHI Server

The visual health information server (VHI) is where a local VHI database is located. It is a database dedicated to store high resolution health images.

#### C. Front-End Server

The server is responsible for sending/querying data to and from the central server. It represents the interface between local world

and central servers. Front-End server is also responsible for synchronizing local database with the central database especially in cases of internet connection failure.

In such case, the Front-End server start to compare time stamp of rows in local database with the time of last batch sent to the central server. Rows which have time stamp later than last batch time are queued for batching to the central server as soon as internet connection is back.

### 2.4. DFD for case history subsystem

It may also called (patient information subsystem), Figure (6) illustrate Level 1 data flow diagram for patient information subsystem .the figure demonstrates the main data flows between processes.

## **2.5. ERD for case history subsystem**

Figure(7) show main entities in case history subsystem and relations between them.

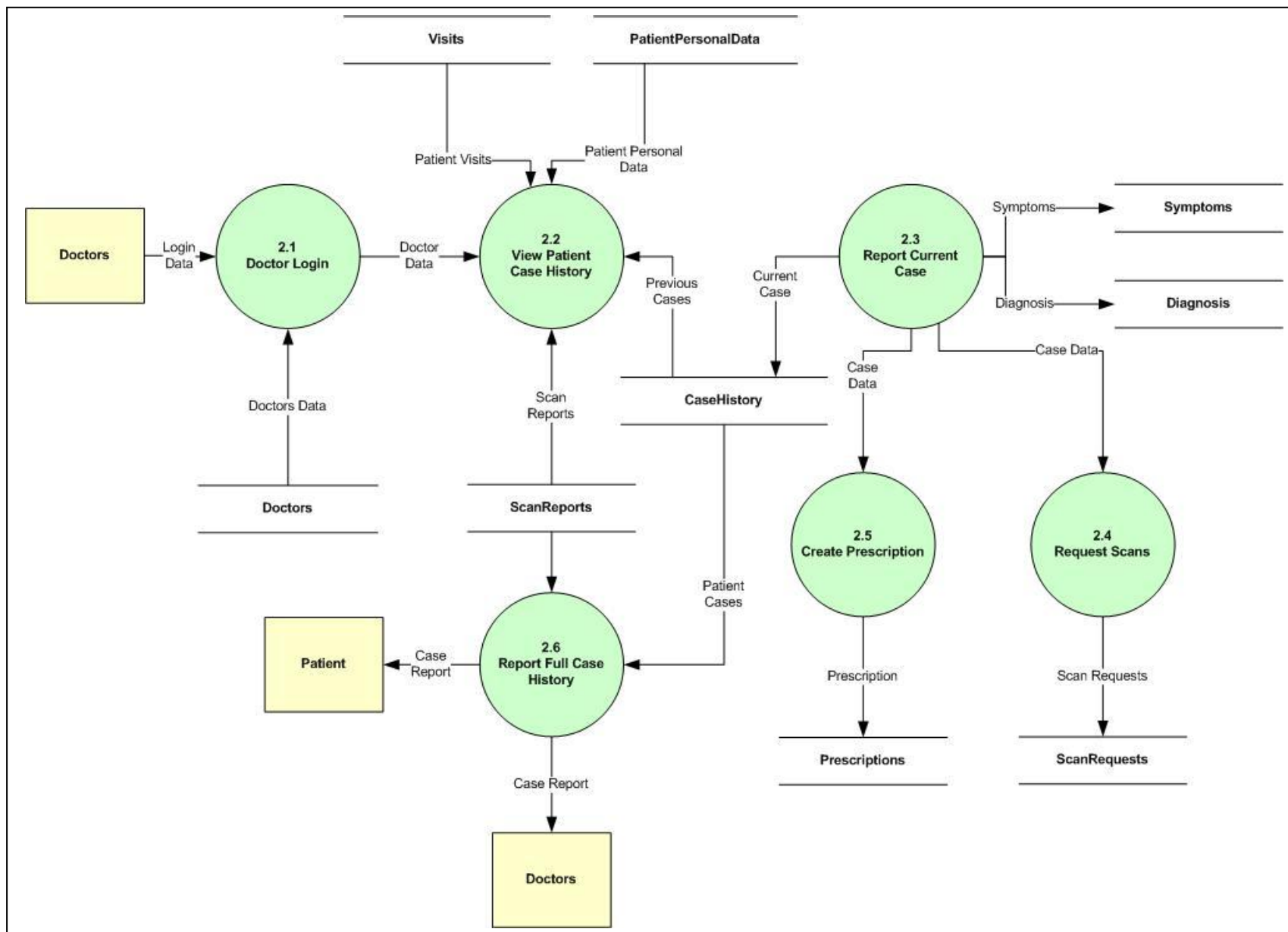


Figure.6: DFD level 1 for process 2 PIS

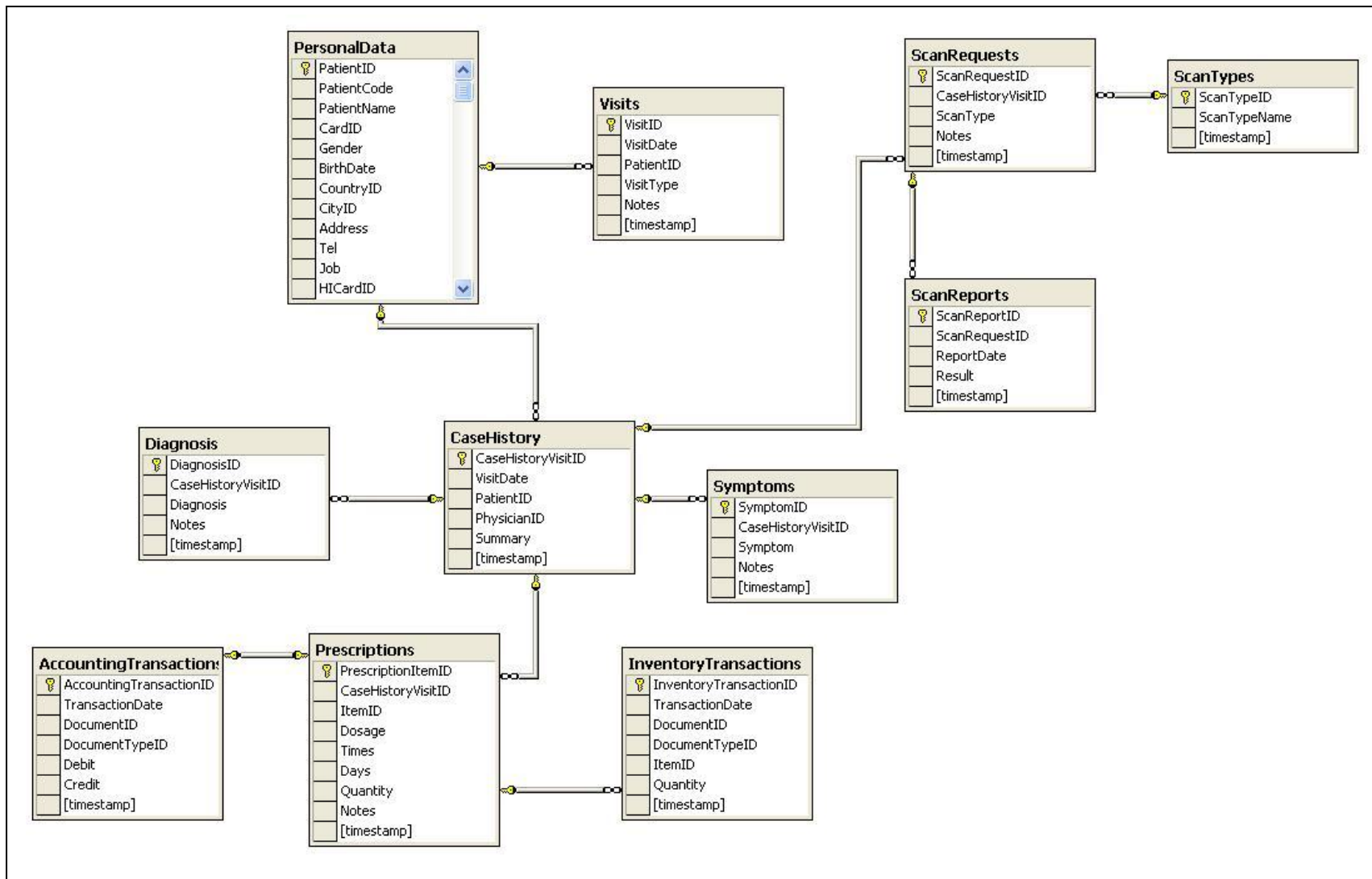


Figure. 7: ERD for PIS

## 2.6. Data Flow and synchronization of card data

The confirmation of health insurance and updating of other data is carried out through the network, which links the self-service terminals to the central compulsory and voluntary health insurance databases.

The current data are downloaded to the card memory. When presenting the card at the doctor's, the insured person thus transfers current data to the health care and health

insurance officers, holders of the health professional

The health care worker inserts his/her health professional card into a special purpose device, a card reader, and logs in with his/her personal password. When the patient enters the doctor's office, his card is inserted in the second slot of the same reader. The card reader enables the health professional card holder to read and modify card data in his/her competencies. The data are displayed on the local computer screen and, as required, saved in the local databases.

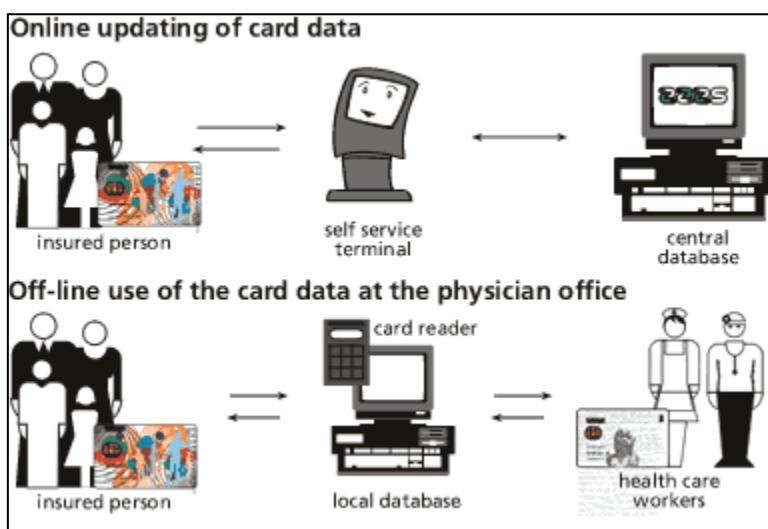


Figure 8: Online and offline data updating

The system grantee that if there is no internet connection between local site and central database, data will be saved in local site and when connection established automatic update will be made.

## 3. Components of a Smart Card System <sup>(1)</sup>

The configuration of the smart card platform will vary substantially from project to project

depending upon the card management approach, card personalization and issuance procedures, card capabilities and applications, and technical environment selected by the project. However, the following components will typically comprise a smart identification card platform see fig. (9)

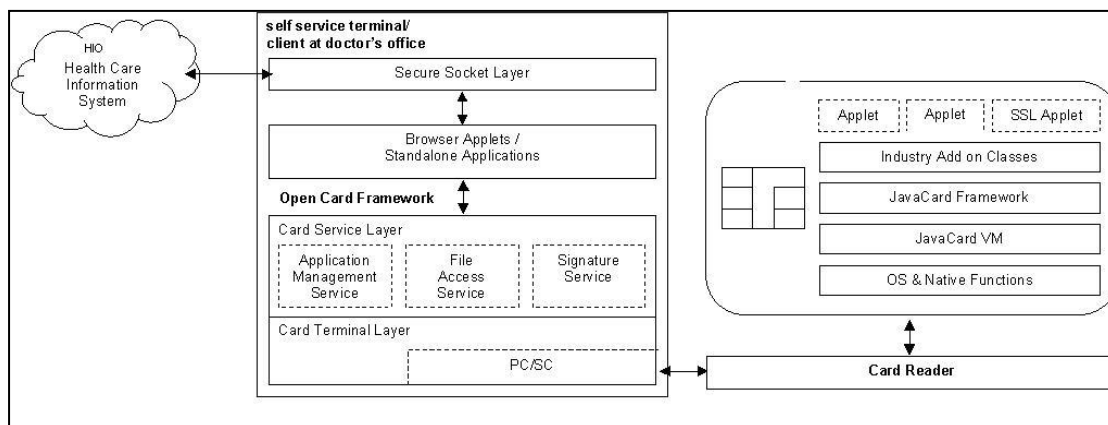


Figure 9: Card platform

### 3.1.Data Types on the Patient Data

#### Card

The administrative part of the information is stored on the card by the health-insurance funds. The medical data is voluntary and is inserted on the card by health professionals or the patient .

- **Constant Data :** Constant data comprises administrative data such as insurance and address data as well as emergency information. It may, for example, also include information on chronic illnesses or organ-donor information .
- **Transfer Data :** Transfer data refers to information such as electronic prescriptions, referrals and admission requests .
- **Dynamic Data :** Dynamic data is the data which is modified in the course of the patient's life, e.g. the medication, treatment and health history. Depending on the scope of the data or the system architecture preferred, the card can be used as data carrier or as a pointer to data and as an access key.
- **Cards :** Smart cards contain an ICC that provides computational power similar to that of a PC. Smart cards have the

capability to implement multiple authentication technologies such as PKI and biometrics. They also have a certain amount of storage capability. Smart cards are generally used for both physical and logical access, and are available with both contact and contactless interfaces.

- **Central Card Management System.** The central card management system should function as the core of the smart card system, and as such, requires connectivity and interfaces with all other system components. It houses the central cardholder database that supports the capture, storage, retrieval, retention, integrity, and management of data necessary for the Life Cycle Management (LCM) of smart cards. LCM includes: pre-issuance, issuance, status, replacement, renewal, post-issuance capabilities and audit of smart cards for each agency.
- **Smart Card Equipment and Software.** Smart card equipment and software includes the computers, peripherals, and software needed to capture the information used to enroll a cardholder, personalize the card, load the card with

any necessary PKI certificates, issue the card to the cardholder, and perform post-issuance capabilities such as PIN reset and certificate updates on the card. Card issuance equipment typically includes:

- **Enrollment Workstation.** The enrollment workstation is used to capture enrollment information and route it to the central card management system and to the equipment actually personalizing and issuing the cards (if not the enrollment workstation itself). At agency discretion, attachments to the enrollment workstation may include a digital video camera to capture the cardholder's digitized photo, a digitized signature capture device, a biometric capture device (most commonly a fingerprint capture device but could include a wide variety of biometric capture devices), and a key pad used for generating a user's PIN. Depending on the procedures for capturing demographic data (e.g., through manual entry or legacy system upload), the enrollment workstation may be used to collect demographic data for card personalization. In some implementations, the biometric data and/or public keys captured through the enrollment workstation could be directly routed to the certificate/attribute authority workstation as part of a certificate request.
- **Key Generation Workstation.** Although key pairs generally will be generated by a cryptoprocessor on the smart card, some agencies may choose to use a separate workstation to generate keys (i.e., using software-generated keys rather than token-generated keys). Once keys have been generated, they are securely transmitted (using mutual authentication protocols and encryption (symmetric or asymmetric)) and loaded onto the card at the point of card personalization and issuance.
- **Card Personalization System.** The card personalization system is used to personalize the card with data, photos, key pairs (if not generated on the card itself), and digital or attribute (i.e., biometric) certificates. Attached to the card personalization workstation is a card reader that is used to load information to the chip on the card and a card printer that is used to print information and photos on the face of the card. In some scenarios, the card personalization workstation and enrollment workstation may be the same device, depending on whether a centralized (i.e., bulk personalization) or decentralized (i.e., on-site issuance) process is used for card personalization and issuance.
- **Registration Authority System.** In some scenarios, if an agency has a designated registration authority, a separate workstation may be used to read public keys from the card (or verify biometric data), document identity proofing, and generate a digital certificate (or attribute certificate) request. In turn, the registration authority system may receive signed certificates from the certificate authority (or attribute authority) and place them on the card. The registration authority workstation could be the same as the enrollment workstation and the card personalization system in an on-site card issuance location.
- **Certificate/Attribute Authority System.** The certificate and/or attribute authority



system is a trusted computer system that receives certificate requests (that would contain public keys and data or a biometric template) from the entity acting as a registration authority, and, in turn, signs and issues certificates that are returned to the registration authority (or enrollment workstation/card personalization system) for loading onto cards. The certificate or attribute authorities typically will maintain their own repositories (i.e., Lightweight Directory Access Protocol (LDAP) servers) that are used to publish certificates.

- **Card Reader.** A card reader is used to communicate with the smart card during a transaction. It is the interface between the card and the host system. Card readers provide power and timing to the ICC and can operate with either contact or contactless interfaces.
- **Applications.** Smart cards used to implement physical and logical access control applications, as well as other applications that are components of an agency's card system. Depending on the card management approach, these applications may communicate with the central card management platform to upload back-up transactions and/or to download hot lists.
- **Interfaces to Legacy Databases.** Many agencies will choose to personalize their smart cards with data from existing legacy systems. Thus, important components of the platform architecture are the interfaces from legacy systems to the central cardholder database or to the card issuance workstation.

### 3.2. Smart card Operating System <sup>[URL2]</sup>

Every smart card has an operating system. It is the hardware-specific firmware that provides basic functionality as secure access to on-card storage, authentication and encryption. Only a few cards allow writing programs that are loaded onto the smart card - just like programs on a computer. This is a great way to extend the basic functionality of the smart card OS. Some of popular operating system:

#### COS OS

The smart card's Chip Operating System (frequently referred to simply as COS; and sometimes referred to as the Mask) is a sequence of instructions, permanently embedded in the ROM of the smart card. Like the familiar PC DOS or Windows Operating System, COS instructions are not dependent on any particular application, but are frequently used by most applications. Chip Operating Systems are divided into two families:

- The general purpose COS which features a generic command set in which the various sequences cover most applications, and
- The dedicated COS with commands designed for specific applications and which can even contain the application itself. An example of a dedicated COS would be a card designed to specifically support an electronic purse application.

The baseline functions of the COS which are common across all smart card products include:

- Management of interchanges between the card and the outside world, primarily in terms of the interchange protocol.
- Management of the files and data held in memory.

- Access control to information and functions (for example, select file, read, write, and update data).
- Management of card security and the cryptographic algorithm procedures.
- Maintaining reliability, particularly in terms of data consistency, sequence interrupts, and recovering from an error.
- Management of various phases of the card's life cycle (that is, microchip fabrication, personalization, active life, and end of life).

In most cases the issuer has to commit to a specific application developer, operating system and chip for each service the issuer wished to provide to its customer base. This leaves almost no flexibility to change any of these components without having to invest funds into a new software and/or hardware implementation. As a result early smart cards were costly and inflexible. But today we can clearly see a development towards open operating systems that support multiple applications.

For on-card application development of programs that run inside the secure environment of the smart card chip, we highly recommend operating systems that have bigger market exposure such as JavaCard OS, MultOS and lately Windows for smart cards.

### **Multi Application Card Operating Systems (MACOS)**

Until the emergence of multi-application smart cards, each software application representing a product or service on a card was written for a specific operating system, which in turn was specific to a particular hardware (chip) or silicon platform supplier.

Multi-application operating systems allow the development of multiple applications that run on one card. Ideally the on-card applications can't interfere with each other and are protected by a firewall. Currently there are three major operating systems on the market

### **Java Card is a multi-application**

JavaCard is a multi-application operating system for smart cards. JavaCard is an open, multi-application operating system for smart cards. Diverse parties can develop applications using their Java programming skills. The resulting applets run on the same card and they all co-reside independently. This way applications from various vendors can be combined, all separated from each other.

Until the emergence of multi-application smart cards, each software application representing a product or service on a card was written for a card specific operating system, which in turn was particular to a hardware (chip) or silicon platform supplier. In most cases there wasn't even an operating system between the hardware layer and the card edge.

From a card issuer perspective, an issuer had to commit to a specific application developer, operating system and chip for each service the issuer wished to provide to its customer base. The issuer had almost no flexibility to change any of these components without having to invest funds into a new software and/or hardware implementation. Early smart cards were therefore costly and inflexible.

From a consumer perspective, cardholders were forced to carry a different card for each service or function they wished to benefit from. If the product or service they benefited from changed in any way, they would receive a replacement card.

JavaCard has changed the smart card proposition for both issuers and cardholders. Java cards provide increased convenience and flexibility for users while delivering savings and a wealth of opportunities for issuers across all business sectors.

### **Application Load & Unload in JavaCard OS.**

JavaCard allows applications to be loaded on-the-fly. This means that a card with the JavaCard operating system on it can change features during its lifetime. For example a student who has been issued a smart card with JavaCard on it, can load applications (java applets) over the Internet. Of course this would require the correct authorization. But the interesting part is that this can happen securely over insecure networks. This way the student can change the set of available applications over the smartcard's lifetime. One day it could contain an electronic purse and a metro travel application. The next day the student will add an electronic key to get logical access the university network. This is extremely beneficial for both, the cardholder and the card issuer

### **MULTOS**

MULTOS is a multi-application operating system for smart cards for highest security needs. MULTOS is the first, open, high security, multi-application operating system for smart cards (hence 'MULT-OS'). The beauty of this system is that diverse parties can develop applications that are running on the same card and they all co-reside both independently and securely. This way applications from various vendors can be combined, all securely separated from each other.

The open nature of the MULTOS platform allows anyone to issue cards, write applications, implement the operating system on a specific chip, manufacture smart cards or provide value added products which support MULTOS.

From a card issuer perspective, an issuer had to commit to a specific application developer, operating system and chip for each service the issuer wished to provide to its customer base. The issuer had almost no flexibility to change any of these components without having to invest funds into a new software and/or hardware implementation. Early smart cards were therefore costly and inflexible.

From a consumer perspective, cardholders were forced to carry a different card for each service or function they wished to benefit from. If the product or service they benefited from changed in any way, they would receive a replacement card.

As the leading high security, multi-application operating system, MULTOS has changed the smart card proposition for both issuers and cardholders. MULTOS provides increased convenience and flexibility for users while delivering savings and a wealth of opportunities for issuers across all business sectors.

### **3.3. System benefits**

Major system benefits may be listed as follows:

**Insured persons:** benefits in terms of service quality, independence and autonomy in confirming administrative data;

**health professionals:** reduced administrative and paper work, more time available for quality professional tasks, electronic transfer of data onto the existing forms, electronic

linking to different expert information systems;

**Employers:** total elimination of the issuing and confirmation of the health care identification booklets, reduced administrative tasks;

**Health insurance providers:** improved currency and accuracy of data, rationalized data flows, reduced administrative tasks, improved quality of services, support to analyses and timely and appropriate implementation of measures of proper fund allocation.

**Society:** simpler and better transfer of data between the partners in the health care system, improved personal data security, transparency in the field of financial liabilities among different cooperating subjects, positive long-term national scale economic effects due to optimization of operation of the health care sector.

#### 4. Conclusion

The movement to e-government, at its heart, is changing the way people and businesses interact with government. E-Government offers a huge potential in seeking innovative way to reach the ideal of government of people, by people and for people.

Although there are a number of applications that can benefit from smart card technology, the main driving force for using smart cards in medical science has been identifying the patient and critical information about the patient such as allergies, the medication that the patient is on, blood type and other information that can help doctors and other medical personnel apply proper care to the patient without suffering long delays. The portability and security provided by smart

cards make them appealing to health organizations. When coupled with secure web sites holding detailed data about the history of a patient, medical smart cards seem to be the smart choice for solving our hard-rooted problems.

Now after designing smartcard-web-based system it is recommended to apply it for HIO in order to: first, to overcome its problems, second to make this sector as a part of Egyptian e-government, third for the following:

- Decrease in the amount of time taken to perform patient registration.
- Decrease in the amount of time taken to access a patient's medical records.
- Decrease in the number of recording errors in medical records.
- Increase in productivity among staff due to less time dealing with paperwork.
- Decrease in the amount of time that patients have to wait for service.
- Increase in successful life saving medical encounters due to the availability of emergency data.
- Using web-based system and smartcard technology achieve reliability and availability

*The new system discussed in the paper is cost efficient improvement in patient care because it:*

- a. Provides pertinent patient information for emergency use that:
- Gives patient demographics.
  - Describes the patient's current medical condition(s).
  - Lists the patient's current medications.
  - Alerts health care professionals to allergies and other need to know conditions.
  - Enables effective contact with the patient's primary physician.
- b. Allows the patient to quickly and securely access medical records in the patient's primary database, using a web site on the Internet.
- c. Information being updated to HHS, can also be updated to the patient's smart card concurrently, or added to a patient's smart card at another time.

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Also Security architectures proposed using SSL protocols and user authentication within the system allow for increased patient medical data confidentiality by providing access only to entitled professionals. Providing better, faster, and secure access to patient clinical information, smart cards sit at the heart of the qualitative evolution of medicine.

## References

- 1- Bill Holcombe ,GOVERNMENT SMART CARD HANDBOOK ,Office of Governmentwide Policy,February 2004
- 2- [URL 1]  
<http://www.bi-me.com/main.php?id=29&t=1> last seen june-2012
- 3- [URL 2]  
<http://www.cardwerk.com/smartcards/sm>